

भारतीय मानक
Indian Standard

IS 17442 : 2020

विनाइल क्लोराइड मोनोमर — विशिष्टि

**Vinyl Chloride Monomer —
Specification**

ICS 71.080.20

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भारतीय मानक ब्यूरो
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Price Group 5

Organic Chemicals, Alcohols and Allied Products Sectional Committee, PCD 09

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Organic Chemicals, Alcohols and Allied Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Vinyl chloride monomer (VCM) is chemical intermediate for manufacture of poly-vinyl chloride (PVC). VCM exists in the form of a gas (at room temperature) with a sweet odour. It is highly toxic, flammable, and carcinogenic. Exposure to vinyl chloride *via* inhalation, has been shown to increase the risk of liver cancer in humans.

PVC is very stable, non-flammable, lightweight resin used to manufacture durable plastic products, including pipes, wire and cable coatings, films and packaging materials.

The composition of the Committee responsible for the formulation of this standard is given at Annex G.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

VINYL CHLORIDE MONOMER — SPECIFICATION

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for vinyl chloride monomer (VCM).

2 REFERENCE

The following standards contain provisions which through, reference in this text constitute the provisions of the standards. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No./ Other Publications</i>	<i>Title</i>
IS 1070 : 1992	Reagent grade water — Specification (<i>third revision</i>)
IS 2362 : 1993	Determination of water by Karl Fischer method — Test method (<i>second revision</i>)
IS/ ISO 9001 : 2015	Quality management systems — Requirements (<i>fourth revision</i>)
IS/ISO/IEC 17025 : 2015	General requirements for the competence of testing and calibration laboratories (<i>second revision</i>)

<i>IS No./ Other Publications</i>	<i>Title</i>
ASTM A 213 : 2017	Standard specification for seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes
ASTM D 1265 : 2011	Standard practice for sampling liquefied petroleum (LP) gases, manual method
ASTM D 3401 : 1997	Standard test methods for water in halogenated organic solvents and their admixtures
ASTM D 5507 : 1999	Standard test method for determination of trace organic impurities in monomer grade vinyl chloride by capillary column/multidimensional gas chromatography
ASTM E 203 : 2016	Standard test method for water using volumetric Karl Fischer titration
ASTM E 394 : 2015	Standard test method for iron in trace quantities using the 1,10-phenanthroline method

3 REQUIREMENTS

3.1 The material shall comply with the requirements prescribed in Table 1 when tested as prescribed in col 4 of Table 1.

Table 1 Requirements of Vinyl Chloride Monomer
(Clause 3.1)

SI No.	Characteristic	Requirement	Method of Test, Ref in Annex/IS/ Other Publication
(1)	(2)	(3)	(4)
i)	Appearance and colour	Clear, no suspended matter and colorless	A
ii)	Water content in ppm, <i>Max</i> *	200.0	B/IS 2362/ASTM E 203
iii)	Acidity by mass in ppm, <i>Max</i>	2.0	C
iv)	Non-volatile matter in ppm, <i>Max</i>	100.0	D
v)	Total iron by mass in ppm, <i>Max</i>	2.0	E
vi)	Purity, percent in mass, <i>Min</i>	99.80 min	F/ASTM D 5507

* 500 ppm Max for VCM Produced through calcium carbide/acetylene route.

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3.2 Quality of Reagents

Unless otherwise specified, pure chemicals and distilled or demineralized water (*see* IS 1070) shall be employed in the tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities, which affect the results of analysis.

4 PACKING AND MARKING

4.1 Packing

Vinyl chloride monomer (VCM) is a colourless, flammable gas at room temperature. VCM is often stored as a liquid under pressure. The liquid evaporates readily at ambient temperatures. Significant quantities of VCM manufactured world over are transported in bulk consignments of few tens or hundreds of metric tons.

Transporting VCM presents the same risks as transporting other flammable gases, such as propane, butane (LPG) or natural gas (for which the same safety regulations apply).

4.2 Marking

4.2.1 Each container/consignment shall be securely closed and shall bear legibly and indelibly the following information:

- a) Name and grade of the material;
- b) Lot or batch number and date of manufacture;

- c) Tare, gross and net mass; and
- d) Indication of the source of manufacture.

4.2.2 If the product is bulk loaded for example, onto vessels through pipeline, the product marking on the container is not applicable (*see* 4.2.1) and the product information as mentioned in 4.2.1 can be provided in shipping/transport documents, such as invoice and/or packing list and/or bill of lading or any other relevant shipping documents.

4.2.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

5 SAMPLING

The method of drawing representative samples of the material by using SS sample bombs having rupture discs and dip tubes as per ASTM D 1265.

SS-316 gas sampling cylinders of appropriate make can be used. Testing of material of construction (MoC) of containers could be done as per ASTM A 213. The material of construction could also be SS-304/304-L and appropriate cylinder/bottle configuration (single or double ended) is also permitted.

ANNEX A

[Table 1, Sl No. (i)]

DETERMINATION OF COLOUR

A-1 APPARATUS

A-1.1 Erlenmeyer Flask — 250 ml.

A-1.2 Filtration is optional. If filtration is done, filter assembly with hoke stainless steel removable filter (5-9 micron) is suggested.

A-1.3 Grounding strap with alligator clip attachment.

A-1.4 Water bath (warm tap water).

A-2 PROCEDURE

A-2.1 Humidity can interfere with the visual inspection by coating the flask with frost. This can be remedied by dipping the bottom of the flask into a water bath and drying with a paper towel.

A-2.2 Connect the filter assembly to the VCM sample cylinder.

A-2.3 Connect the grounding strap to the sample cylinder.

A-2.4 Transfer approximately 50 to 100 ml. of filtered VCM to the flask.

A-2.5 Place the flask in the warm water bath to remove any frost.

A-2.6 Take the flask from the bath and wipe the outside with a paper towel to remove moisture.

A-2.7 Hold the flask at about eye level and visually inspect the sample for color and clarity. The sample should be colorless, clear, and free of suspended matter. A comparison to deionized water should be made if there is any questionable appearance.

A-2.8 Allow the remainder of the sample to evaporate in the fume hood.

A-2.9 Record the results in LIMS under the appropriate sample record.

NOTE — In addition to above procedure, if found desirable, cooling of VCM may be done using methanol and dry ice in an appropriate apparatus.

ANNEX B

[Table 1, Sl No. (ii)]

DETERMINATION OF WATER CONTENT

B-1 Determine the moisture content in VCM by Karl-Fischer method as prescribed in IS 2362/ASTM D3401/ASTME 203.

B-2 Coulometric Titration (as per ASTM D 3401) could be done as an option to capacity titration. Besides

this, in line with the relatively recent developments, later generation pyridine free karl fischer reagents and methanol can also be used.

NOTE — In addition to above procedure, if found desirable, cooling of VCM may be done using methanol and dry ice in an appropriate apparatus.

ANNEX C

[Table 1, Sl No. (iii)]

DETERMINATION OF ACIDITY

C-1 SCOPE

This procedure is used for analyzing HCl content of VCM process and final product samples.

C-2 APPARATUS

C-2.1 Vinyl chloride scrubber station (consists of needle valve, ¼” stainless steel tubing, tygon tubing, gas dispersion tube, and supporting framework).

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C-2.2 Balance 300 0 g capacity with accurate to 0.1 g.

C-2.3 Burette — 10 ml with graduated in 0.05 ml divisions or equivalent.

C-2.4 Burette — 25 ml with, graduated in 0.1 ml divisions or equivalent.

C-2.5 Glass Cylinder — 225 ml capacity, or equivalent with flared flange neck, without pouring lip.

C-2.6 Magnetic Stirrer Bar — 30 mm diameter or equivalent.

C-2.7 Magnetic Stirrer

C-2.8 pH Meter

C-2.9 Erlenmeyer Flask or any other Appropriate Flask — 250 ml.

C-2.10 Burette — 25 ml Class B.

C-3 REAGENT

C-3.1 Deionized Water, with pH between 5.0 and 7.0.

C-3.2 0.01 N NaOH standard solution.

C-3.3 1.0 N HCl standard solution.

C-3.4 Bromothymol Blue or Bromophenol Blue or Bromo-cresol-purple or Phenolphthalein, indicator can be used.

C-4 PROCEDURE

C-4.1 Place a magnetic stirring bar into the glass cylinder. Add approximately 150 ml of deionized water to the cylinder.

C-4.2 Check the pH of the water in the glass cylinder. Place the glass cylinder on the magnetic stirrer and stir at a medium rate of speed. Put the pH electrode into the water and wait for the pH reading to stabilize.

C-4.3 Slowly add 0.01 N NaOH drop wise, if necessary, to adjust the pH of the water to 5.00 - 7.50 pH range. Always wait for pH meter reading to stabilize after reagent addition to allow the water to become well mixed. This stabilized pH reading must be noted on the glass cylinder or on the VCM area work sheet. Do not use water that is < 5.0 pH. Normally deionized water is in the 5.5 to 6.0 pH range, so adjustments are not necessary.

C-4.4 Place the glass cylinder, containing the stabilized pH water, into the fume hood. Put the gas dispersion tube into the water making certain it goes near the bottom of the glass cylinder. This will ensure that the vinyl chloride has a large volume of water to diffuse through.

C-4.5 Place the full vinyl chloride sample cylinder on the top loading balance. Record the weight to the nearest gram.

C-4.6 Make certain that the needle valve on the scrubber station is closed. Connect the vinyl chloride sample cylinder to the scrubber station, while making certain that there are no leaks in the connections.

C-4.7 Fully open the top cylinder valve. Slowly and cautiously open the scrubber station valve. If the valve is opened too fast, a sudden surge of vinyl chloride will blow the water out of the glass cylinder. Carefully adjust the valve to allow the vinyl chloride to bubble through the scrubber water at a moderate rate.

C-4.8 Periodically check the bubbling rate and make adjustments as necessary.

C-4.9 After all the vinyl chloride has been bubbled through the scrubber water; close the scrubber valve before removing cylinder to prevent water from getting into scrubber station. Close the sample cylinder valve and disconnect the sample cylinder from the scrubber station.

C-4.10 Remove the condensate present on the outside of the sample cylinder. Place the empty sample cylinder on the top loading balance. Record the weight to the nearest gram. The weight of the empty cylinder should then be subtracted from the weight of the full sample cylinder obtained in step C-4.5. This is the VCM sample weight.

C-4.11 If necessary, gently blow any trapped scrubber water in the gas dispersion tube into the glass scrubbing cylinder. Place the glass cylinder on the magnetic stirrer and stir at a medium rate of speed.

C-4.12 Thoroughly rinse the pH meter electrode with deionized water before placing it into the scrubber water.

C-4.13 Place the pH meter electrode into the scrubber water. If the pH of the scrubber water is less than the starting pH (obtained in C-4.3) the vinyl chloride is acidic and must be titrated with 0.01 N NaOH. Record the volume of titrant used. Perform the calculations and report as ppm HCl

C-4.14 Rinse the outside of the gas dispersion tube with deionized water. Wash deionized water through the dispersion tube. Then connect the nitrogen line to the scrubber station and slowly purge nitrogen through the station until it is dry.

C-5 CALCULATION

$$\text{ppm Hcl} = \frac{\text{ml of NaoH} \times N \text{ of NaoH} \times 0.0365 \text{ gm / meq}}{\text{VCM sample wt (gms)}} \times 10^6$$

ANNEX D

[Table 1, Sl No. (iv)]

DETERMINATION OF NON VOLATILE MATTER

D-1 APPARATUS

D-1.1 Grounding Strap, with alligator clip attachment.

D-1.2 Balance, top loading, weighs to 0.1 gm.

D-1.3 Balance, analytical, weighs to 0.1 mg.

D-1.4 Erlenmeyer Flask, 125 ml

D-1.5 A desiccator containing anhydrous calcium sulfate (indicating Drierite), fisher scientific # 07-578-3B, or equivalent or any suitable drying agent.

D-1.6 Metal Tongs

D-1.7 Water Bath (warm tap water)

D-2 REAGENTS

D-2.1 None required

D-3 PROCEDURE

D-3.1 Dirt, fingerprints, or other contamination on glassware will cause false weight readings.

D-3.2 Obtain a clean, dry, 125 ml Erlenmeyer flask that has been stored in a desiccator for at least 60 minutes. Weigh the flask on the analytical balance to the nearest mg. Record the weight.

D-3.3 Connect the sample cylinder filter assembly to the vinyl chloride sample cylinder.

D-3.4 Place the sample cylinder, with filter assembly, on the top loading balance. Tare the balance.

D-3.5 Connect the grounding strap to the vinyl chloride sample cylinder.

D-3.6 Carefully filter approximately 50 ml of vinyl chloride into the flask.

D-3.7 Allow the sample cylinder to remain in the fume hood for one minute. This time is necessary to allow the residual vinyl chloride to evaporate out of the filter assembly.

D-3.8 Disconnect the sample cylinder grounding strap. Place the sample cylinder, with filter assembly, on the

top loading balance. Record the sample weight to the nearest gram.

D-3.9 Allow the vinyl chloride to evaporate from the erlenmeyer flask. To speed up the evaporation process, a warm water bath can be used. Carefully float the erlenmeyer flask in the water bath.

D-3.10 After all the vinyl chloride has evaporated, remove the flask from the water bath and carefully wipe off the water on the outside of the flask with a clean disposable towel (remember to handle the flask with tongs).

D-3.11 Turn the flask horizontally and purge the inside with a very slight flow of nitrogen for approximately 10 s. This will remove any residual vinyl vapours.

D-3.12 Holding the flask with metal tongs, blow off any lint from the outside of it with nitrogen.

D-3.13 After the complete evaporation, the flask with residue is dried in hot air oven at a temperature of 105°C for 60 min.

D-3.14 Place the flask in the desiccator for at least 60 min.

D-3.15 Weigh the flask on the analytical balance. Record the final flask weight to the nearest mg. and calculate the ppm residue.

D-4 CALCULATION

ppm residue =

$$\frac{\text{final flask wt (gms)} - \text{original flask wt (gms)}}{\text{VCM sample wt (gms)}} \times 10^6$$

D-5 CALIBRATION

D-5.1 Calibration of the balances is performed by a subcontractor twice per year. NIST traceable test weights are used to check the accuracy of the balances. Inspections and adjustments are performed in accordance with allometric work instruction 5-4WI03 in compliance with ISO/IEC 17025, ANSI/NCSL Z540-1 and the principles of ISO 9001.

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ANNEX E

[Table 1, Sl No. (v)]

DETERMINATION OF TOTAL IRON

E-1 SCOPE

This procedure is used for process and final product VCM samples. ASTM E 394 is also available for this test and can be followed.

E-2 APPARATUS

E-2.1 Spectrophotometer, with single cell holder for 10 mm square cuvettes or with appropriate facility/flexibility to hold 50 mm cuvettes also.

E-2.2 Cuvettes, 10 mm square or 50 mm

E-2.3 Balance, weighs to 0.1 gm

E-2.4 Erlenmeyer Flask, 250 ml

E-2.5 Graduated Cylinder, 25 ml

E-2.6 Disposable Beakers, 100 and 1 000 ml

E-2.7 Filter assembly consisting of Hoke stainless steel removable filter (5-9 micron) with approximately 8-inch by ¼ inch stainless steel extension tube.

E-2.8 Electric Timer

E-2.9 Static Grounding Strap

E-2.10 Volumetric Flask, 1, 25 ml

E-2.11 Volumetric Flask, 7, 1000 ml

E-2.12 Volumetric Pipettes, 0.5, 1, 2, 3, 4, 5, and 25 ml

E-3 REAGENTS

E-3.1 Deionized Water, reagent grade

E-3.2 Iron reagent powder hach ferrover (readymade reagent available with hach) or any standard reagent can be used, ammonium thiocyanate (5 percent aqueous solution) or any equivalent reagent.

E-3.3 100 0 mg/l Fe standard

E-3.4 Concentrated Hydrochloric Acid

E-4 PROCEDURE

E-4.1 Switch on the Spectrophotometer

E-4.2 Set the spectrophotometer wavelength to 510 nm (or any single selected value uniform for entire procedure ≥ 480 nm and ≤ 510 nm).

E-4.3 Set the instrument to read the values in absorbance mode. Leave the instrument on. Do not turn off except when servicing.

E-4.4 Place a clean 250 ml Erlenmeyer flask in the fume hood.

E-4.5 Connect the sample cylinder filter assembly to the vinyl chloride sample cylinder.

E-4.6 Place the sample cylinder, with the filter assembly, on the top loading balance. Tare the balance.

E-4.7 Connect the grounding strap to the vinyl chloride sample cylinder.

E-4.8 Carefully filter about 50 ml of vinyl chloride into the 250 ml erlenmeyer flask.

E-4.9 Allow the sample cylinder to remain in the fume hood for one minute. This time is necessary to allow residual vinyl chloride to evaporate out of the filter assembly.

E-4.10 Disconnect the sample cylinder grounding strap. Place the sample cylinder, with the filter assembly, on the top loading balance. Record the sample weight, obtained by weight difference.

E-4.11 Allow the vinyl chloride to evaporate from the erlenmeyer flask. To speed up the evaporation process, a warm water bath can be used. Place approximately 800 ml of warm tap water into a 1 litre disposable beaker. Float the Erlenmeyer flask in the water contained in the beaker with the neck of the flask resting on the beaker lip.

E-4.12 After the vinyl chloride has evaporated, add the contents of one portion iron reagent powder as described in E-3.2.

E-4.13 Using a clean 25 ml graduated cylinder, add 25 ml of deionized water to the flask and swirl to mix.

E-4.14 Prepare a blank in a clean 100 ml beaker by adding the contents of one reagent powder package to 25 ml of deionized water.

E-4.15 Allow the solutions to stand for 15 min (*Max* 30 min). This is the color development period.

E-4.16 Verify the instrument wavelength setting is 510 nm (or any single selected value uniform for entire procedure ≥ 480 nm and ≤ 510 nm).

E-4.17 Fill a cuvette with the blank solution and place it in the sample chamber.

E-4.18 Press the '0' ABS/100 percent T button to set blank to 0 absorbance. The display should read 510 nm (or any single selected value uniform for entire procedure ≥ 480 nm and ≤ 510 nm) with 0.00 0 ABS.

E-4.19 Pour the sample solution into a cuvette and place it in the sample chamber.

NOTE — Use same cuvette for both blank and sample solution.

E-4.20 Read and record the absorbance of the sample.

E-4.21 From the calibration chart determine $\mu\text{g Fe}$.

NOTE — If the absorbance reading is over 1.0, then a "greater than" value should be determined based on the chart reading for absorbance 1.0. If an actual result is desired, it will be necessary to rerun the test using a smaller sample size.

E-4.22 Perform the calculations and report as ppm total Fe.

E-5 CALCULATION

$\text{Fe in ppm} = (\mu\text{g Fe})/\text{Sample taken for testing in g}$

E-6 CALIBRATION

E-6.1 Instructions

Prepare a calibration curve as follows:

E-6.2 Pipette 25 ml of the 100 0 mg/l Fe standard into the 100 0 ml volumetric flask.

E-6.3 Add 1 ml HCl

E-6.4 Fill the volumetric flask to the mark with deionized water. Mix well. This is a 25 mg/l Iron (Fe) standard.

E-6.5 Pipette 0.5, 1, 2, 3, 4, and 5 ml of this 25 mg/l Fe standard into six, 25 ml volumetric flasks. These solutions will respectively contain 12.5, 25, 50, 75, 100, and 125 $\mu\text{g Fe}$ per 25 ml solution. Obtain a seventh 25 ml volumetric flask for use as a blank.

E-6.6 Add the contents of one iron reagent powder package, for example, Hach FerroVer (readymade reagent available with Hach or any standard reagent that is used) to each 25 ml volumetric flask. In the case of ammonium thiocyanate, add 5 ml of this reagent into each flask.

E-6.7 Fill, to the mark, each 25 ml volumetric flask with deionized water.

E-6.8 Mix each flask well by inverting the flask several times.

E-6.9 Allow the solutions to stand for 15 min (*Max* 30 min). This is the color development period.

E-6.10 Verify the instrument wavelength setting is 510 nm (or any single selected value uniform for entire procedure ≥ 480 nm and ≤ 510 nm).

E-6.11 Fill a cuvette with the blank solution and place it in the sample chamber.

E-6.12 Press the 0 ABS/100 percent T button to set blank to 0 absorbance. The display should read 510 nm (or any single selected value uniform for entire procedure ≥ 480 nm and ≤ 510 nm) with 0.000 ABS.

E-6.13 Sequentially, starting with the lowest concentration, rinse then fill the cuvette with each standard solution. Place each one in the sample chamber. Read and record each absorbance.

E-6.14 Plot absorbance versus $\mu\text{g Fe}$ on linear graph paper or using a computer spreadsheet. This calibration curve ranges from 0-125 $\mu\text{g Fe}$ per 25 ml of solution.

E-6.15 Calculate the slope of the curve and generate a calibration chart for absorbance readings from 0 to 1.0 with steps of 0.01 absorbance units.

$$\text{Slope} = (\text{Abs}_2 - \text{Abs}_1) / (\text{Conc } 2 - \text{Conc } 1)$$

Where,

Abs = Reading from calibration standard; and

Conc = Concentration of calibration standard

$$\text{Chart Conc} = (\text{Abs}) \times (\text{Slope})$$

Where,

Abs = Each scale reading available from 0 to 1.0

NOTES:

1 As regards E-2 above and the procedures thereafter, any UV-spectrophotometer or atomic absorption spectrophotometer can be used though conformity to ASTM E 394 should at least be maintained.

2 The selected wavelength value could be any one figure ≥ 480 nm and ≤ 510 nm and accordingly such wavelength could be used for setting as in E-4.2, E-4.16, E-4.18, E-6.10 and E-6.12 above.

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ANNEX F

[Table 1, Sl No. (vi)]

DETERMINATION OF PURITY

F-1 GAS CHROMATOGRAPH METHOD

This method determines the concentration of major impurities such as ethylene, acetylene, propylene, 1,3-butadiene, methyl chloride, dichloroethane (ethylene dichloride), light unknowns, heavy unknowns

F-2 APPARATUS

F-2.1 Chromatograph

Equipped with an on-column injector and flame ionization detector.

F-2.2 Chemstation or relevant soft wear with a full scale of 1 mV and a response time of 1 s or less.

F-2.3 Integrating Device

Any device capable of integrating chromatograph peak areas with a repeatability of ± 1 percent relative.

F-2.4 Chromatographic column capillary column, 25 m length * 0.53 mm ID * 1 μ m thickness

F-3 REAGENT AND MATERIALS

F-3.1 Pure Components for Calibration

Ethylene, acetylene, propylene, 1,3-butadiene, methyl chloride, 1,1-dichloroethane, 1,2-dichloroethane.

F-3.2 Carrier Gas

Helium or nitrogen

F-3.3 Preparation and Calibration of Standards in Multi-level

F-3.3.1 Standard Preparation

Prepare a calibration mixture of VCM containing ethylene, acetylene, propylene, 1,3-butadiene, methyl chloride, 1,1-dichloroethane, 1,2-dichloroethane, light unknowns, heavy unknowns. All the above impurity levels should be near the anticipated levels in the sample.

F-3.4 Standardization Procedure

Determine the relative response factors (RRF) of each impurity by adding known quantities of impurities. Prepare standards with impurity levels that bracket the dynamic range of interest. Determine the relative response factor, F, as follows:

F-3.5 Typical Conditions for Chromatographic Separation

Typical oven temperature program

- a) Initial: 40°C for 4.5 minutes
- b) Ramp rate: 7°C/min
- c) Final temp.: 180°C for 12.00 min
- d) Total run time: 36.5 min
Flame Ionization Detectors (FID)
- e) Detector temperature: 275°C
- f) Hydrogen flow: 35 cc/min
- g) Air flow: 350 cc/min
Makeup flow (helium): 15 cc/min

F-4 CALCULATIONS

Relative response factor (F) =

Concentration of component/Average peak area

Set the system sensitivity so that all impurity peaks are recorded at adequate levels for data acquisition. Normally, the minimum peak height will be twice of baseline noise.

F-5 CALCULATION AND REPORT

F-5.1 Calculation

Determine the concentration of each impurity using the following formula:

$$\text{Area count} \times \text{Response factor} = \text{Concentration of component}$$

F-5.2 Report the concentration of each impurity to the nearest mg per kg.

F-5.3 Typical Impurities Level in VCM

Parameter	Specification (wt. ppm)
Acetylene	5 ppm max
Ethylene, propylene	10 ppm, each in both cases
1,3-Butadiene	15 ppm Max
Methyl chloride	150 ppm Max
Ethylene dichloride	15 ppm Max

NOTE — The Gas Chromatographic (GC) conditions mentioned herein in Annex F are suggestive. However, any GC method having difference in Detector, Column packing material and type (like packed / capillary, diameter, length, film thickness etc), Calibration technique (internal std, external std, area normalization, percent area etc), Carrier Gas (He, H₂, N₂) may be used with applicable GC operating parameters, provided standardization and calibration of the components is established after setting GC parameters for the resolution and accuracy level as specified in this standard.

ANNEX G

(Foreword)

COMMITTEE COMPOSITION

Organic Chemicals, Alcohols and Allied Products Sectional Committee, PCD 09

<i>Organization</i>	<i>Representative(s)</i>
Chemical Engineering and Process Development Division, NCL, Pune	DR C. V. RODE (Chairman)
Alkyl Amines Chemicals Limited, Mumbai	SHRI S. V. NIKUMBHE SHRI SAMEER KATDARE (<i>Alternate</i>)
All India Alcohol-Based Industries Development Association (AABIDA), Mumbai	SHRI K. L. RAPHAEL SHRI KIRTI GAJJAR (<i>Alternate</i>)
All India Distillers Association (AIDA), New Delhi	SHRI V. N. RAINA
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National Chemical Laboratory (NCL), Pune	DR UDAYA KIRAN MARELLI
National Test House (NTH) , Ghaziabad	SHRI DEBASHIS SAHA DR GOPAL KRISHAN (<i>Alternate</i>)
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